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ABSTRACT

The science teacher has a vital responsibility to provide the best science curriculum possible to guide optimal pupil progress. Educational objectives need to represent salient scientific knowledge, skills, and attitudes. Proper sequencing of objectives is also crucial. Learning opportunities based on sound educational psychology should be used in science lesson plans. Finally, quality assessment strategies are important for diagnosing students' understanding of scientific concepts. (WRM)

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Problems in Teaching Science

by
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PROBLEMS IN TEACHING SCIENCE

The science teacher has highly important tasks in implementing vital trends in the curriculum. In a rapidly changing society, the science curriculum needs to be assessed and updated where necessary. Changes should not be made for the sake of doing so, but rather due to meeting personal needs of pupils in a world of science. Pupils tend to be curious and interested in science as young learners. Sometimes, this curiosity and interest wears down as pupils progress through diverse levels of schooling. The teacher then has major responsibilities in helping pupils to be attentive in achieving vital objectives in ongoing lessons and units of study.

Thematic units provide a focal point for pupils to be actively involved in attaining objectives. Learning opportunities should guide learners to attain the objectives of instruction. These learning opportunities need to challenge pupils, but not be unduly complex whereby optimal achievement is not possible (Ediger, 1997, Chapter six).

Objectives in Science

Objectives for pupil attainment should stress vital knowledge goals as one of three types of objectives. Securing knowledge emphasizes pupils acquiring facts, concepts, main ideas, and generalizations. A second type stresses application ends. Here, a pupil is assisted to apply what has been achieved in terms of knowledge objectives. Ample opportunities need to be given for pupils collaboratively and individually to use what has been attained in the knowledge domain. With use, less forgetting occurs and, then too, learners might perceive value in learning that which is beneficial.

To be useful as objectives in science instruction, pupils need to have ample chances to engage in solving real problems identified in context. These problems require deliberation and thought in their solving, including the use of critical and creative thinking. Problem solving as well as critical and creative thinking, no doubt, will always be important in school and in society. Many trends and emphases in science teaching may come and go, but these three application skills are indeed worthy to stress presently as well as in the future (Ediger and Rao,1996, Chapter Four).

A third kind of objective to stress continuously is good attitudes of pupils toward the science curriculum. Mental health goals emphasize pupils achieving well in the affective dimension. Wholesome attitudes toward the self and others as well as toward acquiring knowledge and

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application skills in science are indeed worthy for all (See Rao and Ediger, 1996, Chapter Two).

Sequencing Science Objectives

Sequencing objectives for pupil achievement is an important facet of teaching. The ordered objectives, then, should be arranged so that pupils experience new knowledge and skills based upon previously acquired learnings. A seamless web of achievement might then be in the offing. A logical sequence emphasizes the teacher arranging the objectives so that success in pupil learning is increasingly possible. With a psychological sequence, the science teacher assists pupils to identify questions, problems, and solutions they deem to be relevant. A combination of these two approaches is probably the most feasible and acceptable. Pupils differ on the kind of sequence they feel is the most worthwhile. Success in learning is salient for each pupil. Readiness for learning and achieving of new objectives depends much upon what the pupil has already learned and blends in with the new objectives of instruction. The learner should be guided to access what has been learned as well as relate his/he own experiences with the objective to be realized.

Science Learning Opportunities

To achieve objectives, pupils need learning opportunities which capture and maintain learner attention. Unless pupil interest is being accessed, the chances are learning will not accrue as it should. Thus, to establish set, the science teacher needs to provide initiating experiences which engage the learner actively. It is important for pupils to attend to what is being presented for more optimal learning to occur.

Learning opportunities should contain concrete materials (objects, items, realia, excursions, and hands on approaches), semiconcrete materials in teaching science (illustrations, videotapes, CD ROMS, films, filmstrips, drawings, diagrams, graphs, charts, software packages, and multi-media presentations in general), and abstract (reading, writing, listening, and speaking) experiences.

The materials of instruction may well provide content for science experiments and demonstrations which should be the heart of the science curriculum. Methods of teaching may also include problem solving, inductive and deductive activities, projects, pupil/teacher planning in ongoing lessons and units of study, unit teaching and thematic approaches, teacher directed experiences, peer teaching and collaborative endeavors, learning centers and constructivism as a

philosophy of instruction, as well as sustained silent reading involving pupil choice of trade books in science.

Organization of the Science Curriculum

Too frequently in the science curriculum, there are recommendations to use one approach in organizing the science curriculum. I recommend multiple approaches of organizing the science curriculum to provide for individual differences of and in pupil achievement. The separate subjects approach stresses using only one science academic discipline in ongoing units of study. There are times when only a single subject matter area should be taught. Why? Depth learning is important in assisting pupils to acquire vital concepts and generalizations.This procedure tends to fragment learnings for pupils, if used exclusively. An other approach is to correlate two academic disciplines in science. An improved chance is then in the offing for pupils to perceive relationships in knowledge so that comprehension and retention are more likely to occur. In many situations, all science academic disciplines, as these are relevant, need to be implemented in teaching and learning in an integrated science curriculum. Pupils then have more chances to perceive how knowledge may be integrated. They may sense fusion of ideas and attach increased meaning to content in science experiences.

Going beyond the separate subjects, correlated, and integrated approaches to organize the curriculum, a teacher may stress interdisciplinary procedures. In interdisciplinary procedures, the language arts (diverse reading materials and various purposes for writing, oral communication criteria in speaking experiences, and standards for quality listening), mathematics as the language of science, and social studies (the history of science, geographical influences on science, as well as economics, political science, anthropology, and sociology) may provide content for ongoing lessons and units of study as they are deemed significant to aid pupil interest and meaning in leaning. Vital knowledge and skills need to be chosen to stress as objectives of instruction. Pupils need to be assisted to achieve these significant ends.

The Psychology of Instruction

To do better with increased engagement in learning opportunities, pupils need to experience principles of learning from educational psychology (Ediger, 1998, 203-208). There are selected principles which do pay off well when used in teaching science. First, the science

teacher needs to secure the interests of pupils in ongoing lessons and units of study. Here, learning opportunities need to be chosen which will interest learners. The manner of presentation should be such that the pupil has an inward desire to learn and achieve. Pupils need to ask questions pertaining to curiosities felt in these experiences. The questions identified might well become problems areas to be solved. A learning center containing items and objects stressing the new unit in science might well serve as an area of engagement in learning for pupils. The teacher needs to allow ample time for pupils to become fascinated with the items and objects at the learning center. Once problems have been identified, committees may be formed in using a variety of materials to work toward solutions. A committee of four members may serve on each committee. Ideally, learners should volunteer to serve on the committee of their choice. If a special committee needs to be formed to meet interest needs of pupils, this should be emphasized with implementation. Individual problem areas also need to be considered. Needs of each pupil should be met in ongoing science units of study.

Meaning must be stressed as a second vital principle of learning in teaching pupils. For meaning to occur, pupils need to understand that which is being taught. Comprehension on different cognitive levels should be emphasized in each science lesson. If pupils do not attach meaning to what has been learned, the chances are the subject matter and skills being taught will soon be forgotten.

A third principle of learning emphasizes pupils perceiving purpose in learning. To sense purpose, the pupil needs to feel that there are valid reasons for achieving and developing. Thus, each pupil with purpose perceives one or more important reasons for active engagement in ongoing learning opportunities.

Fourth, individual differences need to be provided for in the science curriculum. To provide for individual differences, the teacher needs to provide for the learning styles of learners (See Dunn and Dunn, 1979). Some pupils, for example, like to work on individual endeavors while others prefer committee work. Multiple Intelligences Theory stresses pupils using their unique intelligence(s) to indicate what has been learned (See Gardner, 1993). Here, the following means are available to have learners indicate achievement: scientific, verbal/linguistic, logical/mathematical, visual/spatial, musical, bodily/kinesthetic, interpersonal, and intrapersonal.

Fifth, pupils need to become motivated individuals in studying science. To motivate, the teacher should show enthusiasm for reading science content as well as doing scientific endeavors. The high energy level for teaching science should then be reflected in pupil interest and achievement.

Learners individually should also be assisted to develop a good

self concept for learning. Thus, the teacher needs to help each pupil to be successful in making progress in the science curriculum. Success in achieving objectives in science is a must! Recognition needs of individuals also must be met. Each pupil should be identified for doing well in facets of science regardless of ability levels. It behooves the teacher to observe where esteem needs should be rewarded in ongoing lessons (Ediger, 1998, 541-548).

Assessment of Pupil Achievement

A variety of assessment techniques need to be used to appraise achievement in science (Ediger, 1996, 3-25). Teacher observation of learner progress in context is important. Better sequence in pupil learning might well be an end result when the teacher uses quality standards to assess when observational methods are used. In addition, the following, among others, need to be used to assess and improve the science curriculum for pupils:

1. portfolios and pupil journal writing.
2. diary entries and logs written individually or collaboratively by learners.
3. pupil participation in discussions.
4. project methods of instruction and evaluating their processes and products.
5. art work, written reports, and dramatic experiences as each relates directly to a science lesson or unit of study.
6. tutorial results from software packages, using micro-computers.

The following may be used diagnostically with positive attempts made to remedy vital deficiencies:

1. teacher written tests.
2. standardized, norm referenced tests.
3. criterion referenced tests.

Closing

The science teacher has vital responsibilities in providing the best science curriculum possible to guide optimal pupil progress. The objectives need to represent salient knowledge, skills, and attitudes for learner attainment. Proper sequence of the objectives assists pupils to achieve in a more optimal manner. The learning opportunities need to help pupils achieve the desired ends. Principles of learning from educational psychology used in teaching provide for motivated learners. Quality assessment techniques need to be used to appraise what pupils have learned. What has not been learned needs diagnosis and remediation with excellent learning opportunities.

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